INTRODUCTION TO COMPUTERS

CF351K01-0

RISK ASSESSMENT: *Low*

SAFETY CONSIDERATIONS:

Electrical Shock Hazard

Electrostatic Discharge

ENVIRONMENTAL CONSIDERATIONS:

None

CF351K01-02

TERMINAL LEARNING OBJECTIVE

ACTION: State the basic characteristics and operation of computers.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, and official OMEMS reference material.

STANDARDS: Correctly answer 18 of 25 questions on the basic characteristics and operation of computers.

CF351K01-03

ENABLING LEARNING OBJECTIVE

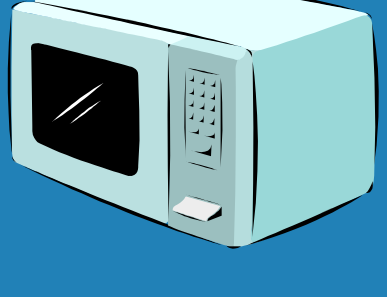
ACTION: Describe a brief history of digital counting and calculating devices.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, and official OMEMS reference material.

STANDARDS: Correctly answer 18 of 25 questions on the basic characteristics and operation of computers.

CF351K01-04

MICROPROCESSORS



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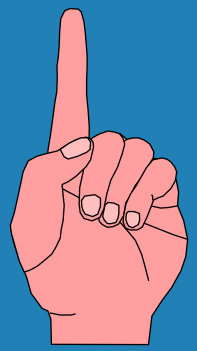
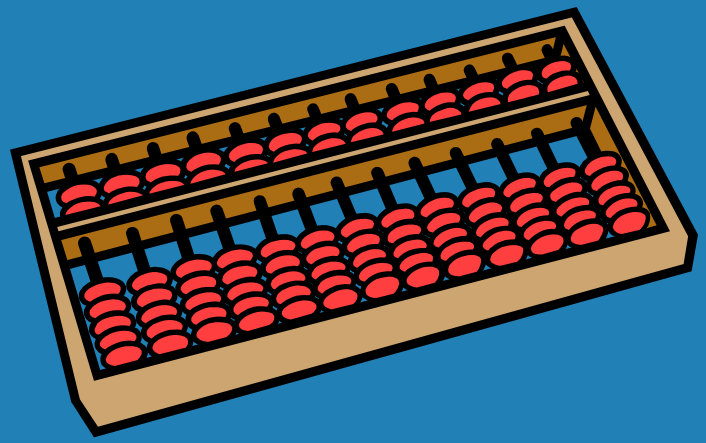
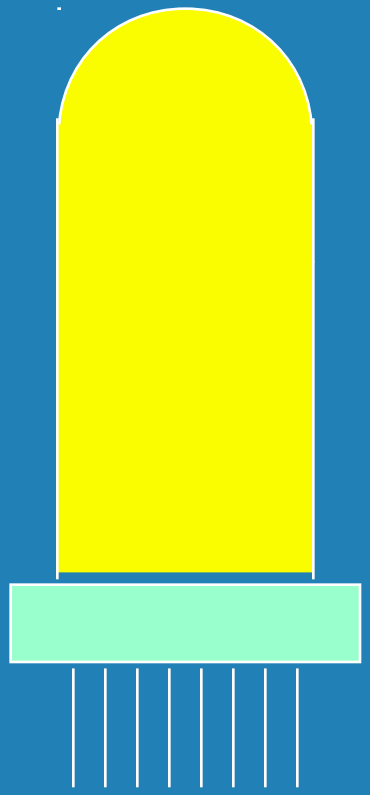
The History of Computing Devices

Mechanical Counting





The History of Computing Devices

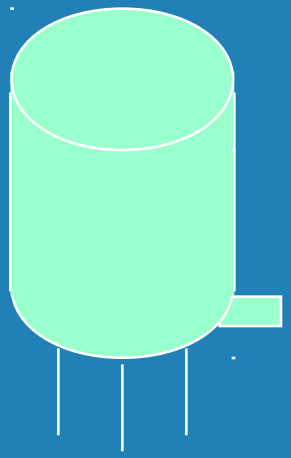


Vacuum Tube

First Generation Electronics

- Unreliable
- Used large amounts of power
- Large

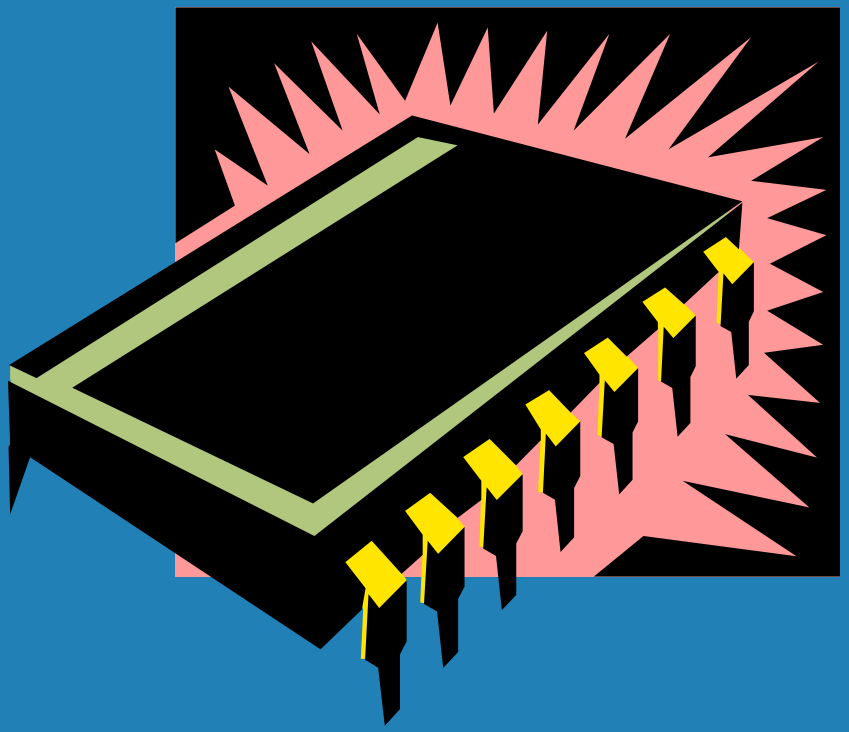
The History of Computing Devices



Transistor

- **Second Generation Electronics**
- Reliable
- Low power use
- Small in size

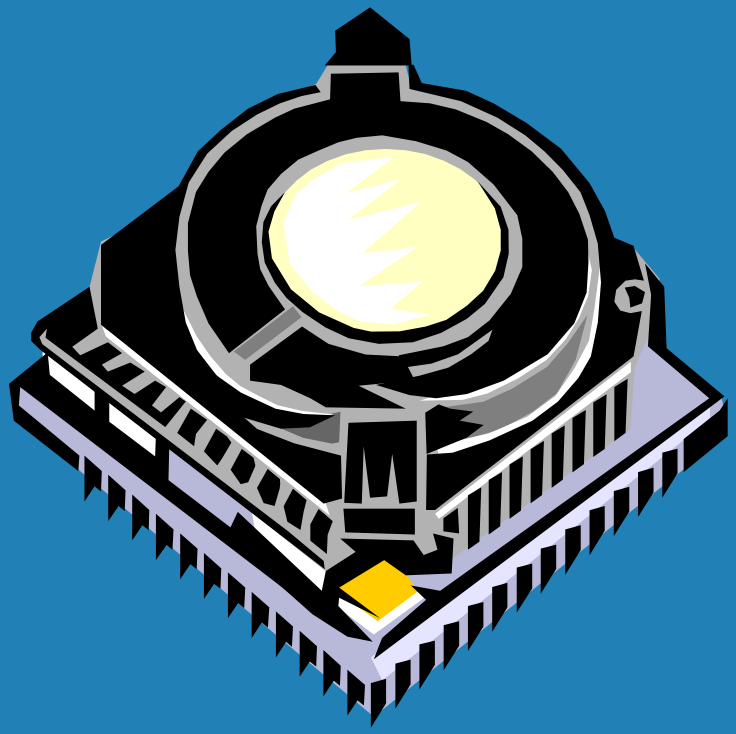
The History of Computing Devices



IC Chip

- **Third Generation of Electronics**
- Holds many transistors
- Low power
- Extremely compact

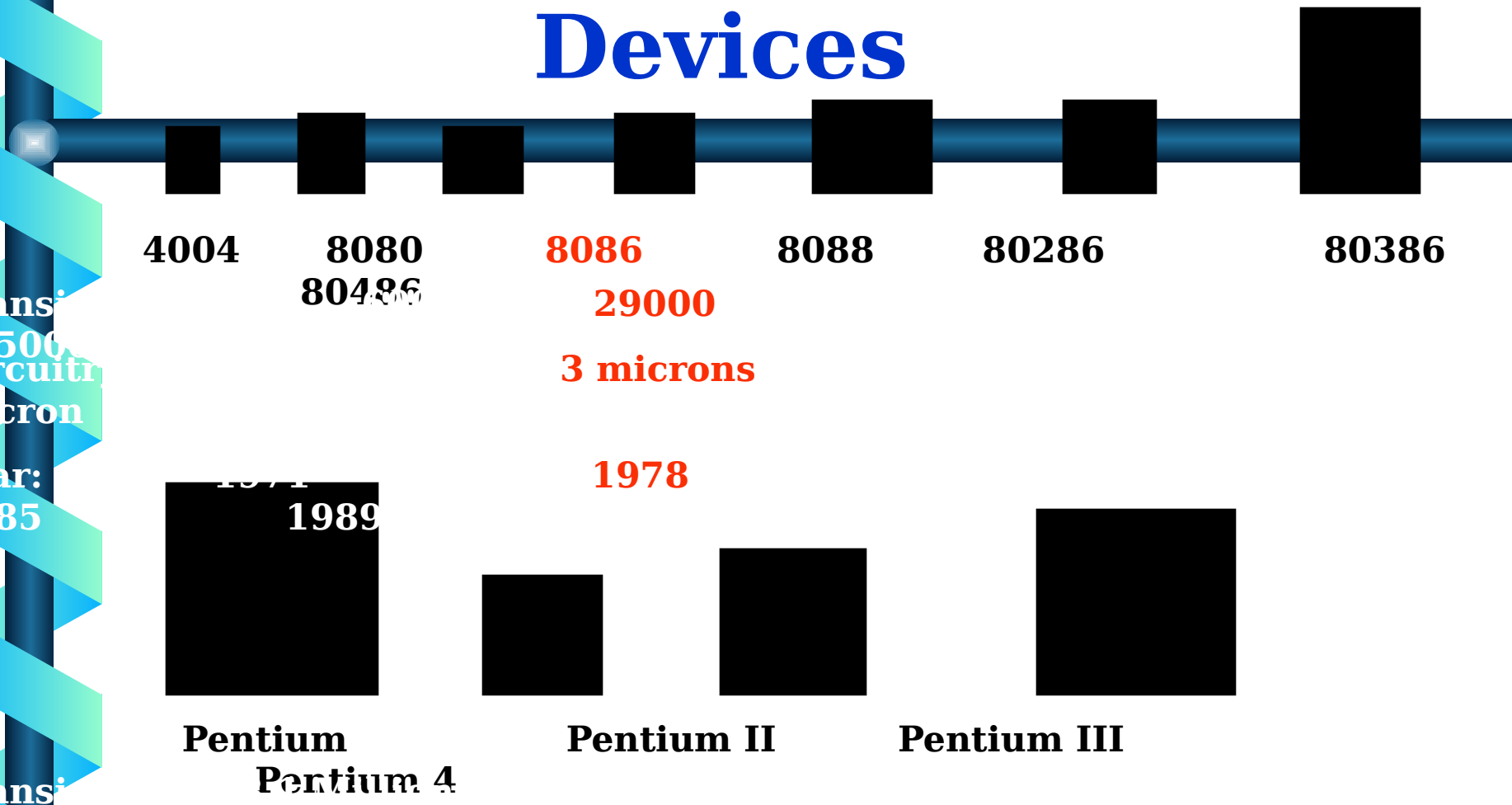
The History of Computing Devices



Central Processing Unit

- **Fourth Generation of Electronics**
  - Small scale integration
  - Medium scale integration
  - Large scale integration
  - Very large scale integration

The History of Computing Devices



1 micron = 1/25,000th of an inch.

Question

- What was the first electronic breakthrough in computers?
  - a. Vacuum tubes
  - b. IC chips
  - c. Transistors

Answer

- What was the first electronic breakthrough in computers?
- a. Vacuum tubes
- b. IC chips
- *c. Transistors*

Question

- What electronic component is used in modern computers?
- a. Transistors
- b. Vacuum tubes
- c. IC chips

Answer

- What electronic component is used in modern computers?
- a. Transistors
- b. Vacuum tubes
- c. *IC chips*

ENABLING LEARNING OBJECTIVE

ACTION: Define terms commonly used with computers.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, and official OMEMS reference material.

STANDARDS: Correctly answer 18 of 25 questions on the basic characteristics and operation of computers.

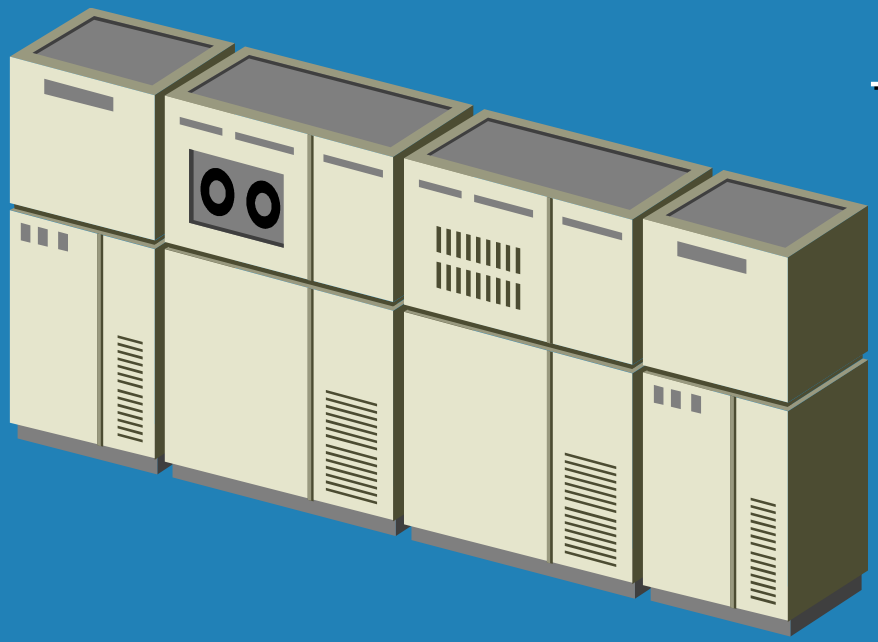
Computer terms

Computer

Definition

A system that rapidly performs calculations and manipulates data

Computer terms



Macrocomputer

Definition

A mainframe or supercomputer used primarily by government and research facilities

Computer terms

Minicomputer

Definition

A computer similar to a macro, but smaller. Usually used by banking and industry.

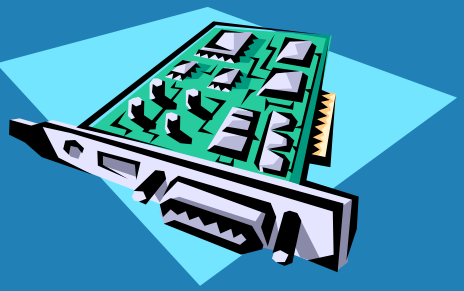
Computer terms

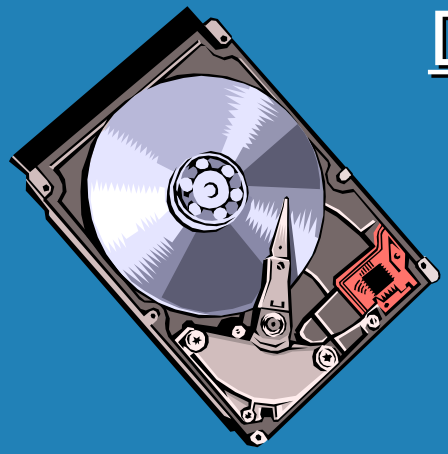
Microcomputer

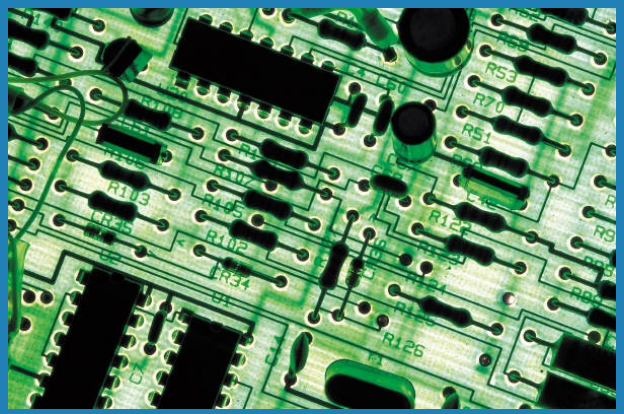
Definition

Smaller than a mini, the microcomputer is the most common. Used by homes and small businesses.

Computer terms





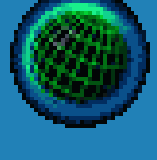


Hardware

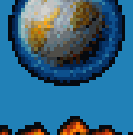
Definition

The physical components or equipment that make up a computer system.

Computer terms



STARCRAFT



WARCRAFT

Microsoft Internet Explorer

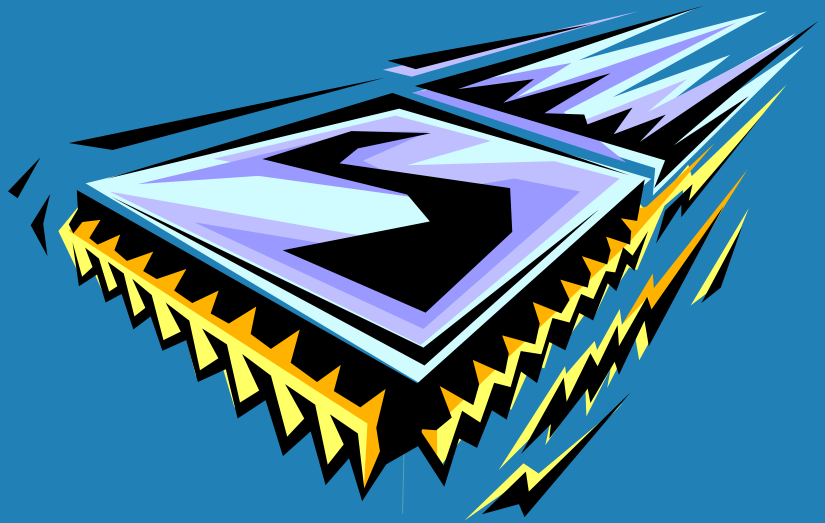
Software

Definition

Written or stored programs used by a computer system. Can be changed by the user.

Microsoft Windows

Computer terms



Firmware

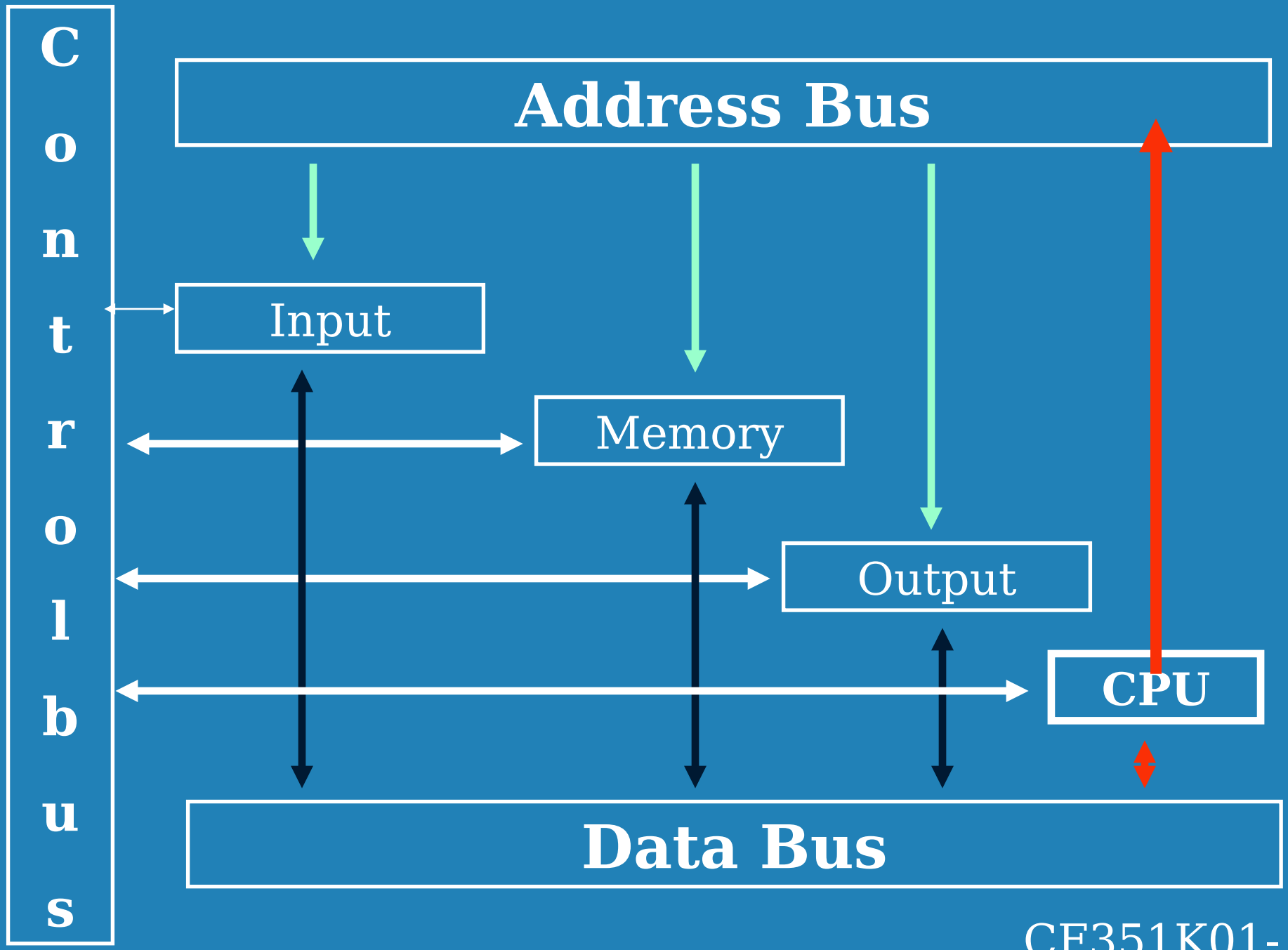
Definition

Programs stored permanently on IC chips. Can not be changed by user.

Computer terms

BUS

- A computer bus is a path for signals with a common function.
- Computers have three common buses. The address bus, the data bus and the control bus.


Control bus
Address Bus
Input
Memory
Output
CPU
Data Bus

8086 Bus Structure

Address Bus

- Selects memory or I/O device
- 20 bits wide / unidirectional

Control Bus

- Provides synchronization and enable signals

Data Bus

- Transfers data and instructions
- 16 bits wide /bi-directional

COMPUTER TERMS

WORD

- A computer word is a set of binary bits treated as a single unit by the ALU.
- The 8086 is has a sixteen bit word (16 bit ALU).
  - 16 BITS
  - 4 NIBBLES
  - 2 BYTES

Question

- What is firmware?
  - a. Program stored on a hard drive
  - b. Programs entered by a user
  - c. Programs stored on ROM chips

Answer

- What is firmware?
  - a. Program stored on a hard drive
  - b. Programs entered by a user
  - *c. Programs stored on ROM chips*

Question

- What bus is used to select memory or I/O devices?
  - a. Data bus
  - b. Control bus
  - c. Address bus
  - d. School bus

Answer

- What bus is used to select memory or I/O devices?
  - a. Data bus
  - b. Control bus
  - *c. Address bus*
  - d. School bus

Question

How many address bits are used by the 8086 microprocessor?

- a. 12
- b. 16
- c. 20
- d. 32

Answer

How many address bits are used by the 8086 microprocessor?

- a. 12
- b. 16
- *c. 20*
- d. 32

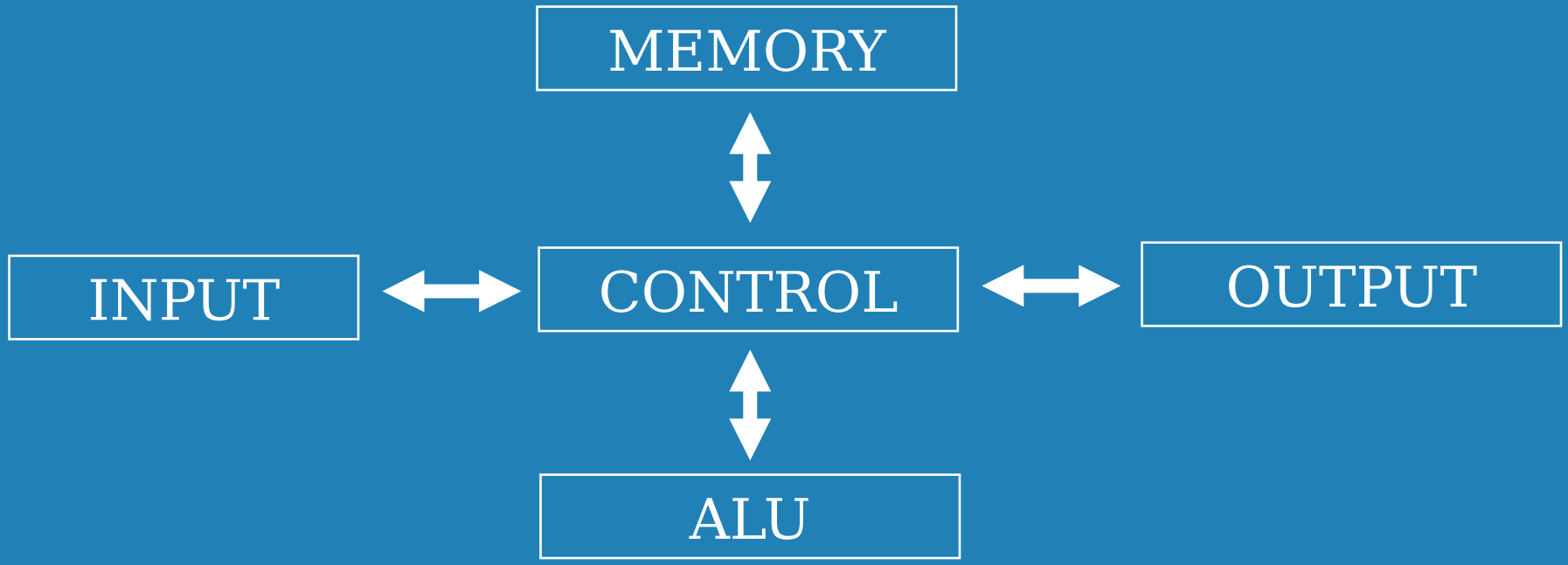
ENABLING LEARNING OBJECTIVE

ACTION: Identify the major parts of a computer and describe their operation.

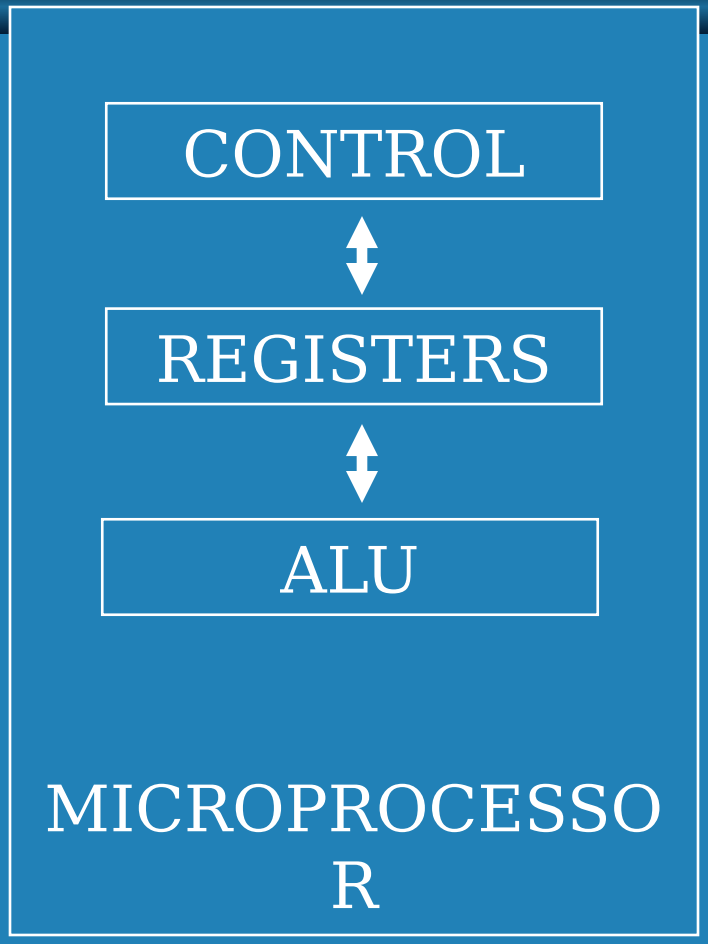
CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, and official OMEMS reference material.

STANDARDS: Correctly answer 18 of 25 questions on the basic characteristics and operation of computers.

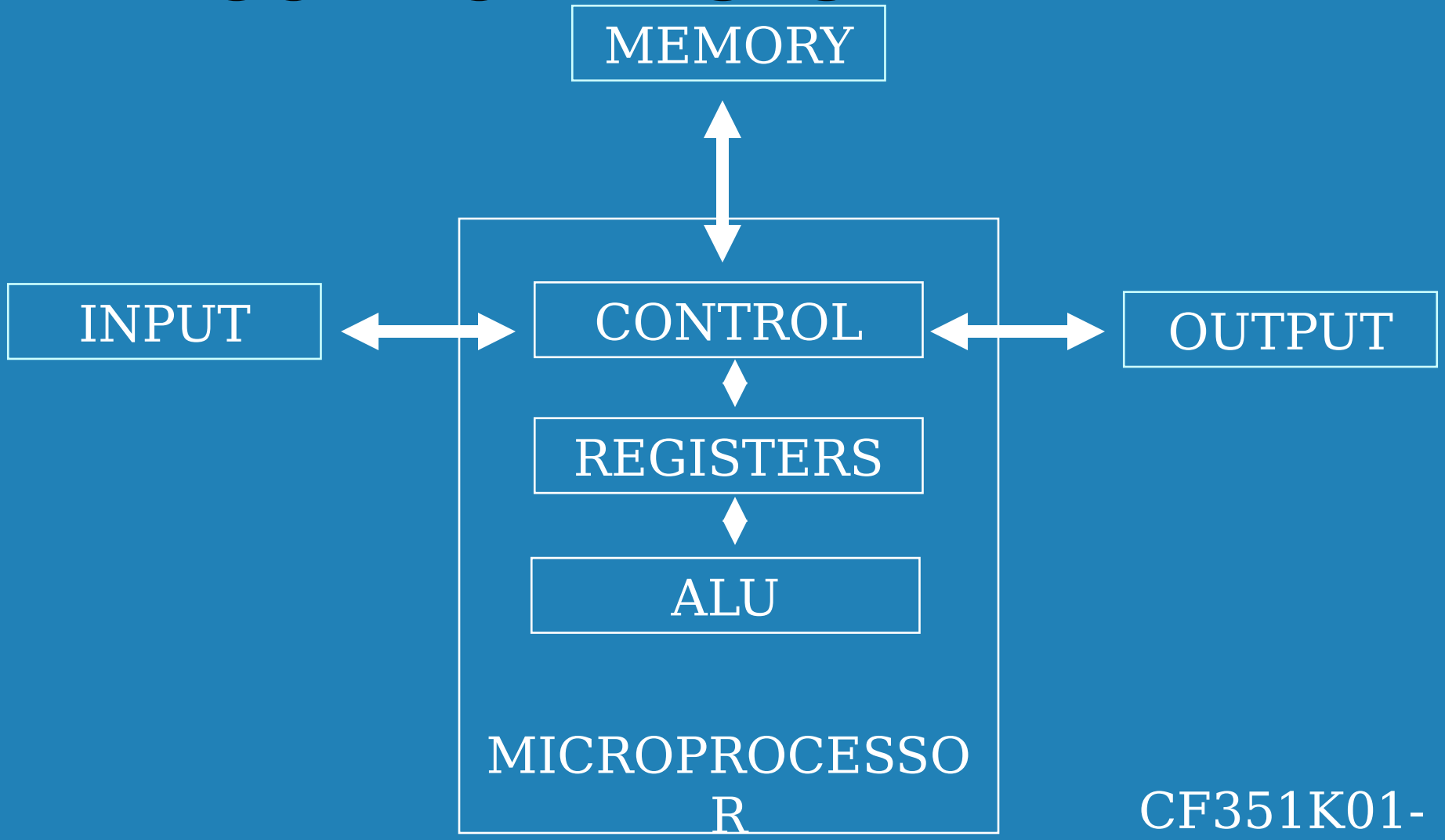
BASIC COMPUTER SYSTEM



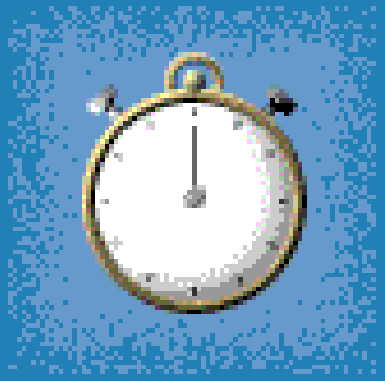
MICROPROCESSOR OR CPU



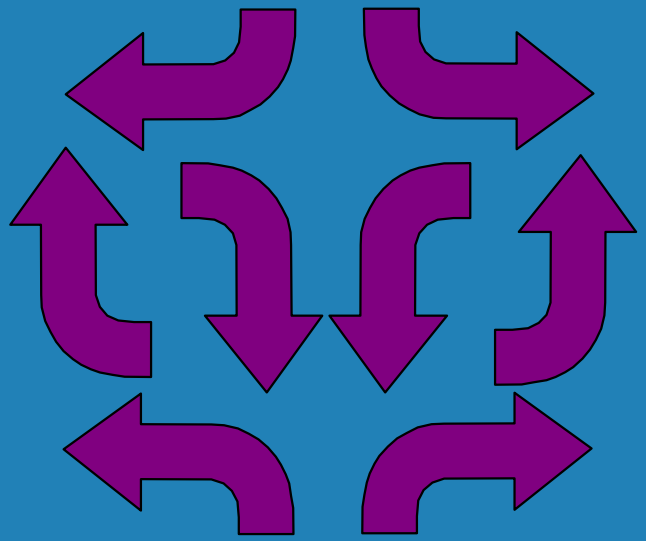
MICROPROCESSOR BASED COMPUTER SYSTEM



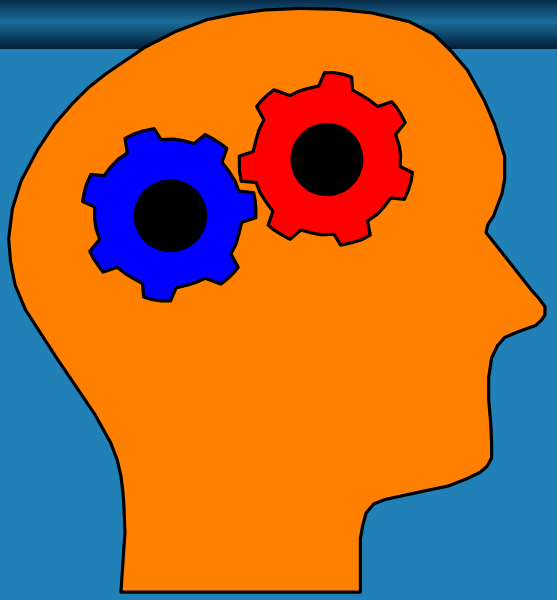
CONTROL UNIT



TIMING



ROUTING

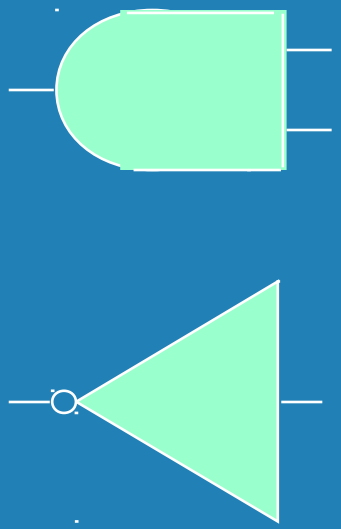


DECODING

ARITHMETIC/LOGIC UNIT

$$\begin{array}{r} 2 \\ +2 \\ \hline 4 \end{array}$$

ADDITION



LOGIC

REGISTERS

- DEFINITION
  - SMALL AMOUNTS OF MEMORY, INSIDE THE CPU, USED FOR PROCESSING DATA AND DIRECTING CPU OPERATION

TYPES OF REGISTERS

- GENERAL PURPOSE
- SPECIAL PURPOSE

GENERAL PURPOSE REGISTERS

- DEFINITION
  - REGISTERS THAT ARE USED TO STORE THE DATA NEEDED FOR THE CURRENT INSTRUCTION.

GENERAL PURPOSE REGISTERS

- Four 16 bit registers: AX(accumulator), BX, CX, DX.
- Registers can be split into a High (H) and a Low (L) byte to form eight 8 bit registers. For example, AX=AH + AL
- AH = Bits 8-15
- AL = Bits 0-7

SPECIAL PURPOSE REGISTERS

- DEFINITION
  - REGISTERS USED TO STORE LOCATION (ADDRESS) AND STATUS INFORMATION

SPECIAL PURPOSE REGISTERS

- INSTRUCTION POINTER
- STACK POINTER
- STATUS OR FLAG
- ADDRESS (SEGMENT)

INSTRUCTION POINTER (PROGRAM COUNTER)

DEFINITION

- THE REGISTER THAT CONTAINS THE ADDRESS OF THE **NEXT** PROGRAM INSTRUCTION.

STACK POINTER

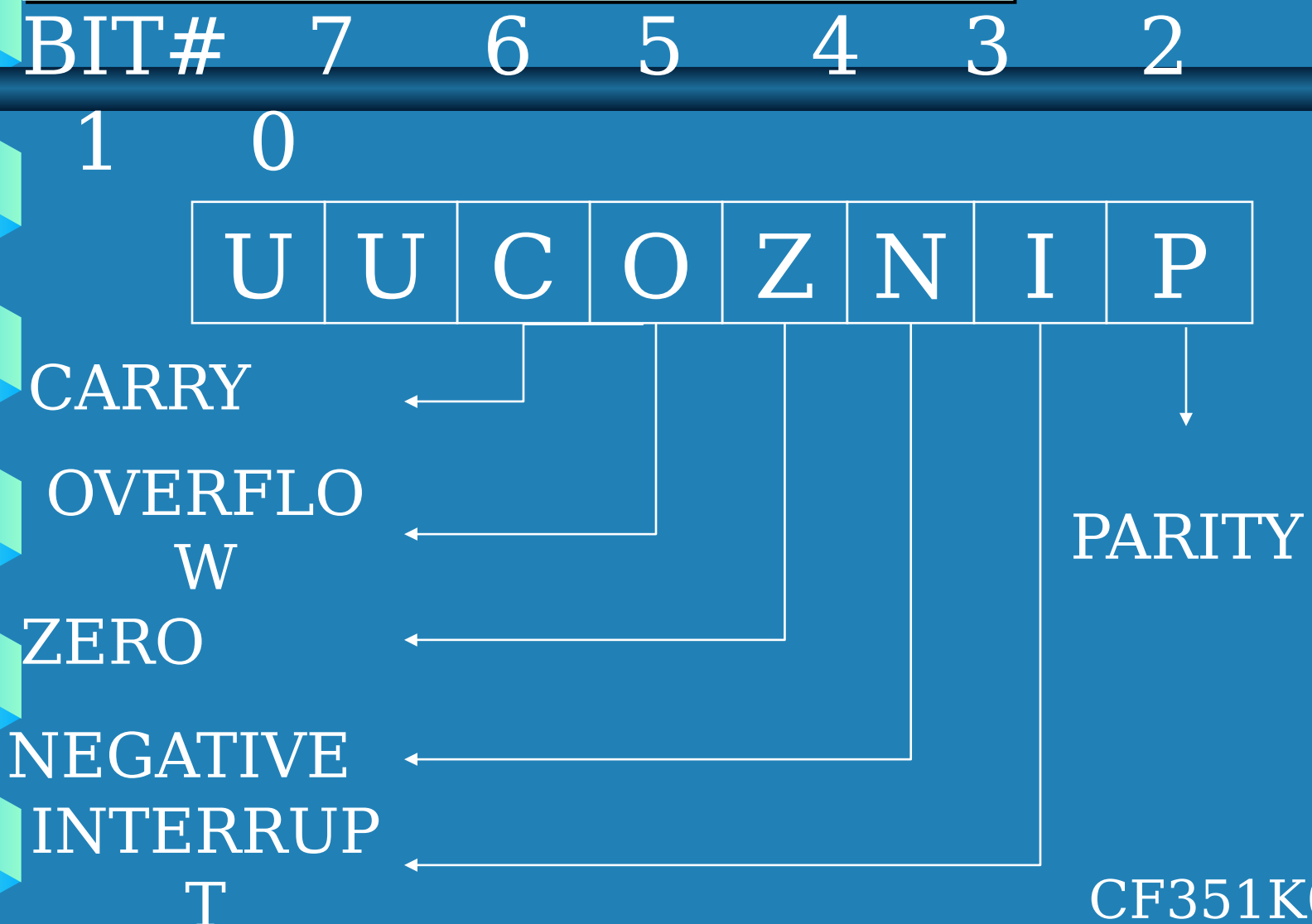
- DEFINITION
  - THE REGISTER THAT CONTAINS THE ADDRESS OF THE NEXT AVAILABLE STACK LOCATION.

STATUS OR FLAG REGISTER

- DEFINITION
  - THE STATUS OR FLAG REGISTER INDICATES THE STATUS OF THE ALU AND OTHER MICROPROCESSOR CONDITIONS.

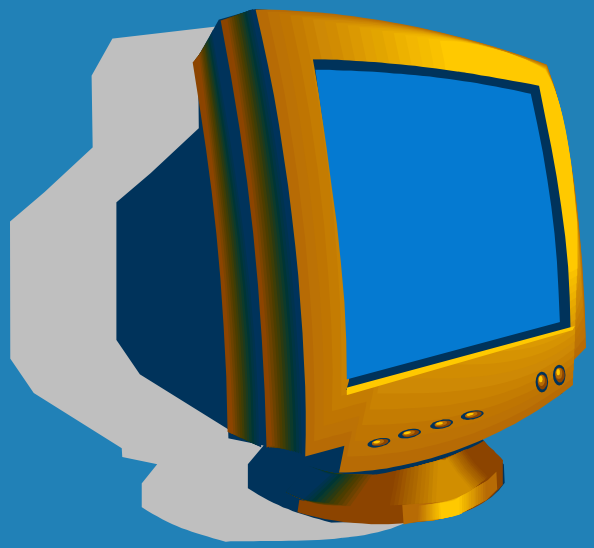
STATUS REGISTER

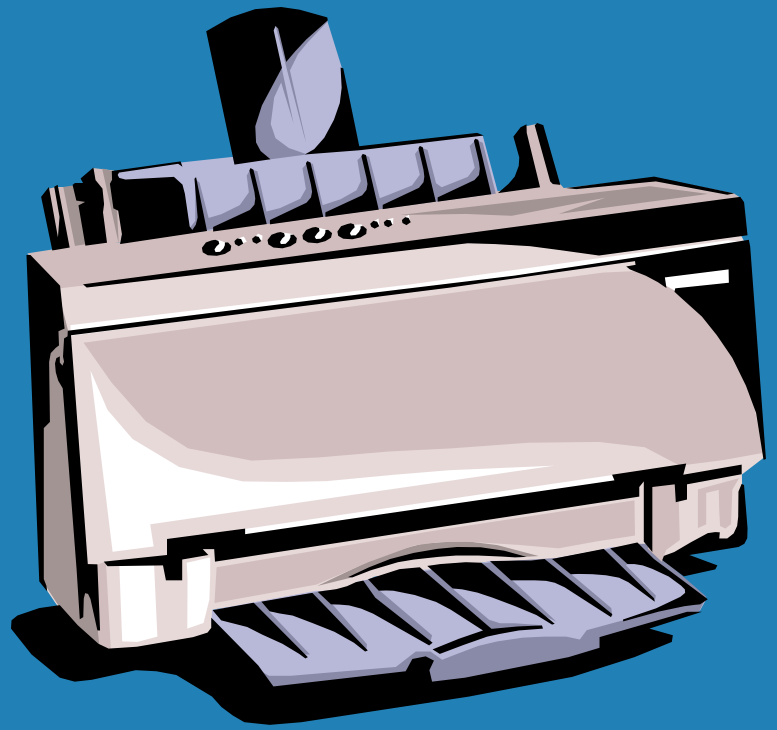
GENERIC FLAG REGISTER



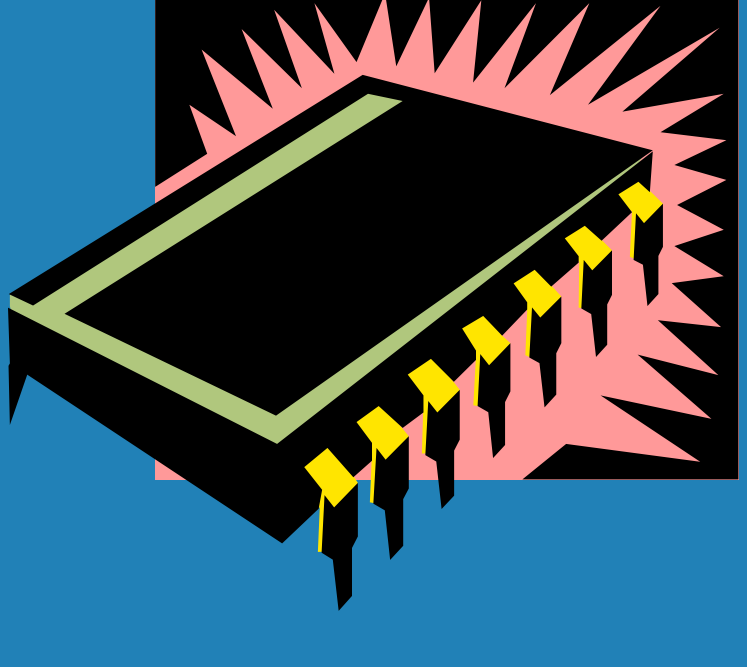
INPUT

OUTPUT





Memory

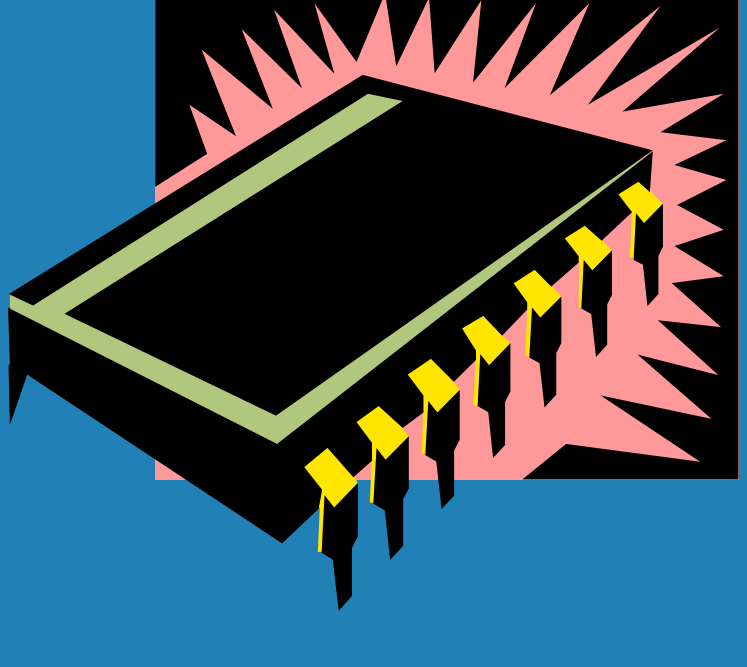


MEMORY

- BINARY DIGIT (BIT) = 1 OR 0
- BYTE = 8 BITS =1 CHARACTER
- KBYTE =1024 BYTES
- MBYTE = 1048576 BYTES =1024 KBYTES

Memory

MAIN



MASS

MAIN MEMORY

- RAM -RANDOM ACCESS MEMORY
- ROM -READ ONLY MEMORY
- PROM -PROGRAMMABLE ROM
- EPROM- ERASABLE PROM
- EEPROM - ELECTRICALLY ERASABLE PROM

MASS MEMORY

- NON-VOLATILE EXTERNAL MEMORY

TAPE

CD-ROM

HARD DRIVE

FLOPPY DISK

OPTICAL DISK

Question

Which of the following is a main memory device?

- a. Hard drive
- b. Tape drive
- c. Floppy drive
- d. RAM

Answer

Which of the following is a main memory device?

- a. Hard drive
- b. Tape drive
- c. Floppy drive
- *d. RAM*

Question

Which of the following statements is correct?

- A. RAM write only, ROM read only
- B. RAM read/write, ROM read/write
- C. RAM read/write, ROM read only
- D. RAM read/write, ROM write only

Answer

Which of the following statements is correct?

- A. RAM write only, ROM read only
- B. RAM read/write, ROM read/write
- C. *RAM read/write, ROM read only*
- D. RAM read/write, ROM write only

ENABLING LEARNING OBJECTIVE

ACTION: Define the fetch and execute cycle

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, and official OMEMS reference material.

STANDARDS: Correctly answer 18 of 25 questions on the basic characteristics and operation of computers.

CF351K01-61

CYCLES OF OPERATION

1. FETCH CYCLE
2. EXECUTE CYCLE

FETCH CYCLE

- During the fetch cycle the processor will:
  - Send out the address of the next instruction on the **address bus.**
  - Send the enable signals on the **control bus.**
  - Transfer the data on the **data bus.**

EXECUTE CYCLE

- During the execute cycle the processor will
  - Decode the received instruction
  - Execute the instruction if it has all of the necessary data
  - If the instruction is incomplete the fetch cycle will be repeated until the instruction is complete.
  - Repeat the fetch cycle for the next instruction

Question

- What bus is used at the beginning of the fetch cycle?
  - a. Control bus
  - b. Data bus
  - c. School bus
  - d. Address bus

Answer

- What bus is used at the beginning of the fetch cycle?
  - a. Control bus
  - b. Data bus
  - c. School bus
  - *d. Address bus*

ENABLING LEARNING OBJECTIVE

ACTION: Complete Introduction to Computers and Basic Computer Functions.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, and official OMEMS reference material.

STANDARDS: Correctly answer 18 of 25 questions on the basic characteristics and operation of computers.

CF351K01-67

SUMMARY

- BRIEF HISTORY OF COMPUTERS
- COMPUTER TERMS
- MAJOR PARTS OF A COMPUTER
- FETCH AND EXECUTE CYCLE